



## Hand tactile discrimination, social touch and frailty criteria in elderly people: A cross sectional observational study



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### ABSTRACT

Frailty is a common syndrome among elderly and sensory decline may exacerbate functional decline. The hand function, the manual dexterity, the performance of the daily living skills and the social interactions are determined, in a large degree, by sensory integrity. However, hand tactile sensory deterioration has been little explored in frailty. We performed a cross sectional observational study with 181 of institutionalized elders. From the initial sample we selected 50 subjects (68–99 years) who met the inclusion/exclusion criteria. Our goals were (1) to analyse the relationship between tactile discrimination (TD) of the hand, avoidance behaviours and attitudes towards social touch (BATST) and phenotype frailty criteria (unintentional weight loss, self-perception of exhaustion, decrease grip strength – GS, slow walking speed, low level of physical activity), (2) to explore whether other variables can contribute to explain the differences between pre-frail and frail elders. The results showed that increasing age is related to decline of TD of the hand ( $p = 0.021$ ) and to decrease in GS ( $p = 0.025$ ); women have significantly lower level of GS ( $p = 0.001$ ); TD decrease is correlated with higher avoidance BATST ( $p = 0.000$ ) and with lower GS ( $p = 0.000$ ); Lower GS corresponds to more avoidance BATST ( $p = 0.003$ ). Hand TD also can differentiate frail and pre-frail elderly subjects in this sample ( $p = 0.037$ ). Decreased TD of the hand may have implications on the functionality and on interpersonal relationships. TD of the hand also explains frailty levels in this sample. Hand TD should be used in assessment and intervention protocols in pre-frail and frail elders.

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## 1. Introduction

Frailty is currently seen as a major problem in public health. It is a multidimensional syndrome of loss of physical, cognitive and health reserves among the elderly. It leads to great vulnerability and it is a predictor of disability, of the need for institutionalization, of the occurrence of falls, and of death (Malaguarnera, Vacante, Frazzetto, & Motta, 2013; Nowak & Hubbard, 2009; Rockwood et al., 2005).

There are several definitions for frailty and over time numerous attempts have been made to create a reliable instrument that can measure it. This reflects uncertainty about the term and its components (Rockwood et al., 2005).

The latest definition (Clegg, Young, Iliff, Rikkert, & Rockwood, 2013) portrays frailty as a state of vulnerability and precarious balance in which the response to stress factors is compromised, thus increasing the risk of falls, delirium, disability, long term care needs and death. This contemporary approach attempts to focus attention on a more holistic view of the elderly, their condition and their life contexts.

Frailty is not synonymous with comorbidity or disability because comorbidities are a risk factor for frailty and disability is a result of frailty (Fried et al., 2001; Lang & Michel, 2009).

These considerations and findings raise questions about how frailty in the elderly can be reliably detected, how it develops and how it can be prevented (Kan et al., 2008; Morley et al., 2013).

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There are several types of evaluation and amongst them the one that contains the largest number of objective criteria is the Phenotype of Frailty (Fried et al., 2001). These criteria have been validated independently and can be used to measure frailty in the context of clinical practice. However, they were selected at random from a cohort study that did not aim to study frailty and does not contain other very important factors for the frailty assessment such as the cognitive level, the presence of depression, or sensory function (Clegg et al., 2013; Lang & Michel, 2009).

One aspect that has been little explored, whether regarding frailty evaluation models or therapeutic interventions in older people with frailty, is the sensory function. Furthermore, whenever sensory function related to frailty is discussed, the only sensory modalities that are taken into account are vision and hearing. However data in the literature (Humes, Busey, Craig, & Kewley-Port, 2013; Schumm et al., 2009; Shaffer, Harrison, Shaffer, & Harrison, 2007) shows that other senses, such as smell, taste and touch are also affected with advancing age. Furthermore the sensory decline in all sensory modalities starts with motor decline.

The assessment of sensory function is an important outcome in health and it is essential to take into account that a sensory decrease can constitute a symptom or can be predictive of other health problems (Schumm et al., 2009).

Specifically related to touch, several authors (Brodoehl, Klingner, Stieglitz, & Witte, 2013; Carmeli, Patish, & Coleman, 2003; Kaneko, Asai, & Kanda, 2005; Wickremaratchi & Llewelyn, 2006) reported that tactile thresholds in healthy elderly are significantly higher than in younger healthy individuals. This fact is probably due to changes in the skin, in central and peripheral nervous system, in the decline in sensory nerve conduction velocity and also in the decrease of the amplitude of the sensory action potential.

For the visually and hearing impaired there are compensation mechanisms through technical aids that minimize these losses, which does not happen in the case of decreased tactile sensibility. With aging there is a sensory decline, and, in most studies related to tactile sensory changes in the elders, only certain body parts are studied, such as the knee and foot region, neglecting sensory changes in the hands (Carmeli et al., 2003).

In this study we will try to emphasize the hand, despite the importance of research in other body parts, including the foot. For instance, related with decreased sensation in the feet, Shaffer et al. (2007) concluded that the structural and functional decline of the somatosensory system that occurs with aging, potentially contributes to the postural instability and may lead to the risk of falls, because in order to maintain a proper and safe postural control we rely primarily on skin and proprioceptive inputs, in addition to visual and vestibular ones.

In the particular case of elderly people's hands, the deterioration of the tactile sensory function occurs due to age-related changes, such as musculoskeletal, vascular and nerve degenerative changes, and changes in the brain centres responsible for unisensorial processing (Brodoehl et al., 2013; Carmeli et al., 2003). There is also a relationship with decreased in grip strength (GS) (Wickremaratchi & Llewelyn, 2006), as well as with loss of hand functionality (Guclu-Gunduz, Citaker, Nazliel, & Irkec, 2012; Melchior, Vatine, & Weiss, 2007; Ranganathan, Siemionow, Sahgal, & Yue, 2001b, ; Wickremaratchi & Llewelyn, 2006). This loss is also associated with a greater dependence in the performance of daily activities (Kalisch, Tegenthoff, & Dinse, 2008).

Tactile perception, unlike other sensory modalities, always occurs within the personal space and plays a complex holistic role, as it influences and is influenced by emotions and the social context. In fact, the sense of touch, in addition to its discriminating function, plays an important role in communication, relationships, sharing of feelings (Craig & Rollman, 1999; Dunbar, 2010; Gallace &

Spence, 2010; Olausson, Wessberg, Morrison, McGlone, & Vallbo, 2010) and mediating and regulating emotions (Hertenstein, Keltner, App, Bulleit, & Jaskolka, 2006).

This reasoning supports the "Social Touch" hypothesis. This hypothesis proposes that the mechanoreceptors non-myelinated afferents, known as C-Touch, provide a neurobiological basis for the development of the social brain, mediate social behaviour and are responsible for maintaining social relationships as they are involved in coding and processing tactile signals associated with affective touch (Björnsdotter, Löken, Olausson, Vallbo, & Wessberg, 2009; Gordon et al., 2013; Olausson et al., 2010). In order to complete the feeling of pleasant touch, a combination of CT and A $\beta$  afferents is required.

Recent studies (McGlone, Wessberg, & Olausson, 2014; McGlone et al., 2012) confirmed that CT-afferents are only present in hairy skin and not in the glabrous skin of the palm. However, a touch on the palm can also be perceived as pleasant for two reasons: (1) A $\beta$ -afferents support pleasant sensations (McGlone et al., 2014); (2) Glabrous skin stimulation might be related to a more cognitive top-down evaluation of touch pleasantness, based on previous tactile experiences (Gordon et al., 2013; McCabe, Rolls, Bilderbeck, & McGlone, 2008; McGlone et al., 2012).

Touch stimulation on the palm can provide both discriminative and affective input to the brain (Gordon et al., 2013).

However, the relationship between tactile sensory decline of the hand and avoidance behaviours and attitudes towards social touch (BATST) in frail elderly people is not explored in the literature.

In this sense, the first goal of this study is to analyse the relationship between the tactile discrimination (TD) of the hand, avoidance BATST and frailty criteria as defined by Fried et al. (2001) in a sample of institutionalized elderly people. The second goal is to explore whether other variables can contribute to explain the differences between pre-frail and frail elders.

We have studied some variables related to the sensory, motor and mental functions (sensory tactile discrimination, unintentional weight loss, self-perception of exhaustion, grip strength), with the activity (walking speed, level of physical activity) and with social participation (behaviours and attitudes towards social touch) in an attempt to perceive the individual in a holistic way.

## 2. Methods

### 2.1. Participants

Three urban residential homes agreed to participate in the study. Of the 181 seniors who live in these institutions, a sample of 50 subjects was established after verifying compliance with the inclusion and exclusion criteria. This is a convenience sample and the inclusion criteria established were the following: to be older than 65 years of age, be institutionalized in a residential home, be willing to participate in the study, and sign an informed consent. Exclusion criteria defined were not to present comorbidities that would lead to changes in sensibility (such as stroke, head trauma, degenerative disease or diabetes), to have no medical diagnosis of dementia, not to possess any cognitive impairment that would prevent the evaluation protocol, and not to have any communication or behaviour impairment.

Throughout the planning and during the study some ethical considerations were made; we received prior approval from an institutional review board and subjects gave their written informed consent in accordance with the Declaration of Helsinki. We also took into account particular ethical issues related to greater vulnerability, both in the physical and psychosocial point of view of the subjects. Secrecy due of the obligation of professional secrecy was safeguarded, ensuring total confidentiality of the data.

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